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**Guidance on Response to Contamination  
Detected in the Ground Water Supply Survey**

**APR 29 1981**

The Office of Drinking Water (ODW) in cooperation with the States, is undertaking a national survey on the quality of ground water (The Ground Water Supply Survey). The survey is underway and it will include sampling and analyses of drinking water derived from ground water at 1,000 locations in the United States. The analytical procedures will identify purgeable halogenated organic chemicals such as the chlorinated solvents (e.g., trichloroethylene) and non-halogenated volatile aromatic hydrocarbons (e.g., benzene). Out of a total of 1,000 samples, 500 will reflect a random selection of sites. Another 500 sites will be selected by the States and EPA as areas with ground waters potentially contaminated by organic chemicals. Among other things, we will use this latter group to determine characteristics that may allow better predictability for locating contaminated sites.

The purpose of this guidance is to assist the States or other appropriate authorities in determining the type of response that they should make in a particular case where organic chemicals are detected in a sample from the survey. We are providing a perspective on the relative health significance of various concentrations of chemicals that might be detected, as well as information on the type and relative urgency of possible follow-up actions to protect the public. Depending upon the circumstances of a contamination incident, one of the appropriate actions could be to identify and control the source of contamination. There are ample legislative authorities for this purpose under existing pollution control legislation. However, such activities are not dealt within this guidance.

Two tables are attached which list a number of chemicals which may be detected in this investigation. The concentration levels in Table 1 reflect a scientific judgment on the health effects of specific chemicals using non-carcinogenic toxicity data. The values in Table 2 are based on the carcinogenic aspects of the chemicals. For each chemical, there are four concentration values listed, shown as categories I-IV. The categories represent differing degrees of concern and differing types of action that should be considered depending upon the level of concentration of the contaminants. Concentration values are not listed for several of the chemicals; the Office of Drinking Water is continuing to collect and evaluate the available data and the tables will be revised as more information becomes available.

When an unregulated chemical is detected in drinking water, the EPA regional drinking water office should be contacted if assistance is required by the State. The Office of Drinking Water's Criteria and Standards Division (CSD) is also available to provide advisory assistance for case-by-case decisions. In instances where there is not a concentration value listed in the table, or an unlisted chemical has been detected, the CSD should be notified and every effort will be made to provide immediate recommendations. The person to contact is Dr. William Lappenbusch, phone 202-472-6820.

Both tables should be referred to when a chemical has been detected. For the same chemical, the concentration levels listed in the two tables in the same category may differ. This is due to the fact that each table was generated from a separate data base which used different toxicological end points. For certain chemicals, there may be questions as to which table to use and what level of concern is appropriate. Examples of the use of Tables 1 and 2 are given below:

- If trichloroethylene was found in drinking water and assumed to be consumed for approximately a year (chronic exposure) before remedial action was implemented, 0.075 mg/l (Table 1) would not pose significant health risks to the most sensitive members of the population. On the other hand, should the duration of the exposure be anticipated to last several years, then an attempt to reach concentrations between 0.005-0.045 mg/l (Table 2) would be used which is based upon carcinogenicity) may be more prudent depending upon population exposure, treatment and associated costs.
- In some cases, like carbon tetrachloride, the excess cancer risk number (0.045 mg/l for  $10^{-5}$  lifetime risk) is provided but no chronic non-carcinogenic number exists since existing dose/response data are not available for the proper duration to allow for such an estimation. In that case, a reasonable approach would be to use the more conservative values in Table 2. In such instances the State should contact the CSD and advice will be provided based upon the specific toxicity of the chemical, the length of exposure, and other factors.
- In the situation where several chemicals are detected in the same water sample, a reasonable approach would be to treat the carcinogenic risks as additive (Table 2). For example:

- If trichloroethylene (TCE) and tetrachloroethylene (PCE) were found in drinking water at concentrations of 0.045 mg/l and 0.035 mg/l, respectively, the excess cancer risk over a lifetime may be estimated as follows:

$$\begin{array}{rcl}
 \text{TCE} & & 1 \times 10^{-5} \\
 \text{PCE} & + & 1 \times 10^{-5} \\
 \hline
 \text{Total} & & 2 \times 10^{-5}
 \end{array}$$

The total risk for these elements would still be in Category II of Table 2.

- If TCE and PCE were found at concentrations of 0.225 mg/l (5 x 0.045 mg/l) and 0.210 mg/l (6 x 0.035 mg/l), respectively, the excess cancer risk may be calculated as follows:

Step 1

$$\begin{array}{rcl}
 \text{TCE} & 5(1 \times 10^{-5}) & = 5 \times 10^{-5} \\
 \text{PCE} & 6(1 \times 10^{-5}) & = 6 \times 10^{-5}
 \end{array}$$

Step 2

$$\begin{array}{rcl}
 \text{TCE} & & 5 \times 10^{-5} \\
 \text{PCE} & + & 6 \times 10^{-5} \\
 \hline
 & & 11 \times 10^{-5} \text{ or } 1.1 \times 10^{-4}
 \end{array}$$

- The total risk for these chemicals would now be in Category I of Table 2.

Addition of the two or more calculated risks is obviously simplistic, but at least it provides a reasonably consistent decision process, assuming that other factors are not mitigating. However, there is a potential for synergistic effects and simple addition of the risks of each carcinogen could thereby underestimate the overall risk.

For mixtures of non-carcinogens, none of which exceed the concentrations in Category III of Table 1, the CSD should be consulted.

In the case of trihalomethanes (THM) being detected, an MCL of 0.10 mg/l is included in the National Interim Primary Drinking Water Regulations. This value was derived taking economics and technical feasibility into account and levels above the MCL should be handled according to normal State procedures. Since THMs are a by-product of the chlorination process, detection of THMs in the raw water would indicate contamination of the ground water; depending upon the circumstances at each site, the source of contamination should be identified and controlled.

**Table 1 - Acute and Chronic Toxicity Factors**

The values in Table 1 are computed from acute, short-term and chronic toxicity considerations (Categories I, II, III, respectively). Category IV values are based upon taste and odor detection data and do not include toxicity factors. This compilation was derived from a number of sources, including Office of Drinking Water SNARLs (Suggested No Adverse Response Levels), recommendations from the National Academy of Sciences (NAS) report, Drinking Water and Health (1977), and other literature as evaluated by the CSD. Those concentration levels in Table 1 which are not identified by asterisks were prepared by the ODW. The other levels, identified by asterisks, were calculated from values delineated in the National Academy of Sciences report or EPA Ambient Water Quality Criteria Documents (1980).

The categories, values and suggested follow-up responses for Table 1 are as follows:

**Category I. Acute Concern Level, High Risk**

This is an unusually high concentration level that may introduce risks from brief exposure (one or a few days) in high risk individuals.

Even though large safety margins normally are included in the computed values, emergency type action should be taken.

- Immediate resampling and verification of the concentration levels.
- Identification of the source of contamination and rectify problem, if possible.
- A ban on water consumption for drinking and cooking.

**Category II. Subacute Concern Level**

This is a high concentration level but the concentrations are about 1/10 of Category I. Action should be immediate.

- Immediate resampling and verification of the concentration levels is essential.
- Identification of the source of contamination and rectify problem if possible.
- A ban on water consumption for drinking and cooking should be considered, especially if the level is likely to persist for more than approximately 10 days.
- Alternate sources should be seriously considered as well as treatment to reduce the levels.

**Category III. Chronic Exposure Concern Level**

Exposure near this level for an extended period would represent a relatively low risk situation, especially if the chemical is not bioaccumulative.

As soon as practical, the following actions are appropriate:

- Resample and verify concentration levels.
- Identification of the source of contamination and rectify problem if possible.
- Initiate long term surveillance monitoring, as concentrations may increase in the future.
- Alterations in the treatment process or consideration of alternate sources.

**Category IV. Taste and Odor Detection**

Detection by taste or odor usually causes public rejection of the water for drinking and cooking uses and may indicate severe contamination and a potential imminent health risk (e.g. the case of benzene where the taste and odor threshold is 2 mg/l but the acute number is 0.35 mg/l). In some cases, the taste and odor levels listed in Table I are lower than the Category I, II or III levels and therefore provide protection as in the case of 1,4-dichlorobenzene. In either case, the cause should be identified and corrective action taken.

Table 2 - Potential Carcinogenic Risks

The concentration levels in Table 2 for the potential carcinogens are derived from risk extrapolations from the NAS's Drinking Water and Health report, or from EPA's Carcinogen Assessment Group (CAG). The Crump multi-stage model was used, and the computed incremental risks assume lifetime (70 years) consumption of 2 liters of water per day containing the chemical at the indicated level. No additional exposures to the chemicals other than in drinking water are considered in these values.

Both the NAS and CAG numbers were included in this table to indicate that risk estimation represents a scientific judgment as to the health risk resulting from a chemical's presence in water. The two values are not identical because different data and parameters were included in each model. For example, the trichloroethylene concentrations associated with a lifetime exposure and cancer risk of  $10^{-5}$  via the CAG and the NAS at the 95% confidence limit are 0.028 mg/l and 0.045 mg/l, respectively. However, for the majority of chemicals, the two values are fairly consistent and indicate the general range of concentration levels that would elicit a response action.

For the purpose of providing advice on the types of follow-up actions that would be recommended when certain levels of contaminants are found, four categories were arbitrarily selected as a means of indicating relative concern levels based on the lifetime risks at these concentrations. It is emphasized that these values are projected from lifetime exposure, and therefore, response actions usually would not be commensurate with risks from relatively short exposures.

The categories, excess cancer risk levels and suggested responses for Table 2 are as follows:

Category I. Projected Lifetime Exposure Risk Larger than 1 in 10,000  
( $> 10^{-4}$ )

This is a situation which would represent a high priority; because of the relatively high concentrations in some cases, immediate action may be warranted (non-carcinogenic vs. carcinogenic data should be compared and other factors such as population exposure, duration of exposure, treatment and associated costs should be evaluated).

- Resample and verify concentration levels.

**DRAFT**

7

- Identify source and rectify problem if possible.
- Consideration given to:
  - switching to alternate source
  - banning water for cooking/drinking purposes

Category II. Projected Lifetime Exposure Risk Between 1 in 10,000 and 1 in 100,000 ( $10^{-4}$  -  $10^{-5}$ )

This is a situation that would represent a high priority concern, but somewhat less than Category I and should generate expeditious action.

- Resample and verify concentration levels.
- Identify source and rectify problem, if possible.
- Take steps to reduce human exposure.
- Initiate frequent monitoring.

Category III. Projected Lifetime Exposure Risk Between 1 in 100,000 and 1 in 1,000,000 ( $10^{-5}$  -  $10^{-6}$ )

This is a relatively lower risk situation that would not require accelerated action. Action should be taken as resources permit.

- Resample and verify concentration levels.
- Identify source and rectify problem if possible.
- Long range surveillance monitoring should be considered because concentrations could increase in the future.

Actions should reflect whether the concentration value detected is at the higher or lower part of the risk range.

Category IV. Projected Risk Less than 1 in 1,000,000 ( $< 10^{-6}$ )

This is a concentration level that represents a negligible risk; this situation should be considered to be low priority.

• Depending upon available resources:

- Resample and verify concentration levels.
- Investigation of the source of contamination and possible rectification of problem.
- Long range surveillance monitoring should be considered because concentrations could increase in the future.



**DRAFT****Table 1: Concentration Levels (mg/l) for Select Chemicals,  
Based on Toxicity Other Than Carcinogenesis**

<u>Chemical Name</u>	<u>Acute</u> <u>I</u>	<u>Short-term</u> <u>II</u>	<u>Chronic</u> <u>III</u>	<u>Taste and Odor</u> <u>IV</u>
Benzene	0.35			2
Carbon Tetrachloride	0.2	0.02		
Chlorobenzene			0.072**	0.1
Dichlorodifluoromethane	100*	43*	1.6*	
1,2-Dibromo-3-chloropropane			0.00005	
1,2-Dichlorobenzene				0.01
1,3-Dichlorobenzene				0.02
1,4-Dichlorobenzene			0.13*	0.0003
1,2-Dichloroethane				29
1,2-Dichloropropane				.0014
Ethylbenzene				0.1
Methylene Chloride	13	1.3	0.15	
Isopropylbenzene				0.1
Styrene			1.3*	0.05
Tetrachloroethylene	2.3	0.18	0.02	0.3
Toluene	120*	10*	0.10*	1.0
1,1,1-Trichloroethane	140*	20*	1.1*	
Trichloroethylene	2	0.2	0.075	0.5
Trichlorofluoromethane	25*	2.2*		
m-Xylene	6.1*	3.2*		1.1
o-Xylene mixture				1.8
p-Xylene				0.5

\* = Numbers calculated from NAS Drinking Water and Health  
for a 10 kg child consuming 1 liter water/day.

\*\* = Numbers calculated from Water Quality Criteria  
for a 10 kg child consuming 1 liter water/day.

Studies are underway to obtain values for the following chemicals:

Bromobenzene  
o-Chlorotoluene  
p-Chlorotoluene  
1,1-Dichloroethylene  
1,1-Dichloroethane  
Cis-1,2-Dichloroethylene  
Trans-1,2-Dichloroethylene  
N-Propylbenzene  
1,1,2,2-Tetrachloroethylene  
1,1,2,2-Tetrachloroethane  
1,1,2-Trichloroethane

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**Table 2: Concentration Levels (mg/l) for Select Potential Carcinogens**

		I	II	III	IV
<u>Carcinogens</u>		( $> 10^{-4}$ )	( $10^{-5}$ to $10^{-4}$ )	( $10^{-6}$ to $10^{-5}$ )	( $< 10^{-6}$ )
Carbon tetrachloride	NAS*	.45	.045-.45	.0045-.045	.0045
	CAG†	.04	.004-.04	.0004-.004	.0004
1,2-Dichloroethane	NAS	.071	.0071-.071	.00071-.0071	.00071
	CAG	.095	.0095-.095	.00095-.0095	.00095
1,2-Dibromoethane	NAS	.0055	.00055-.0055	.000055-.00055	.000055
	CAG				
Tetrachloroethylene	NAS	.35	.035-.350	.0035-.035	.0035
	CAG	.09	.009-.09	.0009-.009	.0009
Trichloroethylene	NAS	.45	.045-.45	.0045-.045	.0045
	CAG	.28	.028-.28	.0028-.028	.0028
1,2-Dibromo-3-chloropropane	NAS	(TO BE DETERMINED)			
	CAG				
1,1,2-Tri-chloroethane	NAS				
	CAG	.061	.0061-.061	.00061-.0061	.0061
1,1,2,2-Tetra-chloroethane	NAS				
	CAG	.017	.0017-.017	.00017-.0017	.00017
Vinyl chloride	NAS	.1	.01-.1	.001-.01	.001
	CAG	.2	.02-.2	.002-.02	.002
Benzene	NAS				
	CAG	.067	.0067-.067	.00067-.0067	.00067

\* NAS: Calculated by EPA/ODW using carcinogenic risks specified by the Safe Drinking Water Committee, National Academy of Sciences.

† CAG: Calculated by EPA/ODW using carcinogenic risks specified by EPA's Carcinogen Assessment Group. Modification made to reflect carcinogenic risks associated with lifetime exposure to drinking water. The contribution from fish/seafood has been excluded.

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